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Primary vitrectomy for pseudophakic retinal detachment: a prospective non-randomized study

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PURPOSE. *To compare the anatomic and functional results of primary vitrectomy alone or vitrectomy-scleral buckling for pseudophakic retinal detachment (RD). Vitrectomy permits a detailed view of the peripheral retina, so otherwise undetectable holes or additional small lesions can be found which, left untreated, may cause a residual RD.*

PATIENTS AND METHODS. *Twenty-four consecutive pseudophakic eyes with pseudophakic RD were operated by vitrectomy and encircling band (Group I) and 27 additional cases were operated on by vitrectomy alone (Group II). Internal subretinal fluid drainage, using liquid perfluoro-n-octane, endolaser, and/or cryocoagulation and fluid-air exchange with SF_6 20%, was applied in all cases. Preoperative findings and intraoperative and postoperative complications as well as final results were analyzed.*

RESULTS. *Preoperatively undetected retinal holes were identified in 7 of the 51 eyes and additional retinal holes were found in 21. The mean follow-up was 14 months for Group I and 11.5 months for Group II. The retina was successfully reattached with a single operation in 22 of 24 eyes (92%) in Group I. One eye had a recurrence of RD due to an unsuccessfully treated preexisting retinal tear. Proliferative vitreoretinopathy (PVR) was observed in one case with recurrence of RD. In both cases, a second operation achieved retinal reattachment. In Group II, the retinas were attached with a single operation and visual acuity improved by an average of four or more lines in 62.5% of the vitrectomy-buckling group and in 55.5% of the vitrectomy group. The most frequent complication was a transient hypertony, in 21 cases.*

CONCLUSIONS. *Surgical treatment of pseudophakic RD, combining vitrectomy and scleral buckling or vitrectomy alone, achieves very good anatomic and functional results. The advantages include more efficient detection of the peripheral detachment causing retinal lesions, and a lower redetachment rate than after extraocular surgery only. (Eur J Ophthalmol 2003; 13: 298-306)*

KEY WORDS. *Pseudophakic retinal detachment, Vitrectomy, Scleral buckling, Retinal tears, Proliferative vitreoretinopathy*

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INTRODUCTION

Conventional buckling surgery is complicated by a higher failure rate for the treatment of pseudophakic than phakic retinal detachments (RD) (1-5). In addition, postoperative proliferative vitreoretinopathy (PVR) is more frequent in pseudophakic than in phakic RD (2-6). These higher complication rates are mainly due to: 1) difficulties in viewing the peripheral retina, leading to problems in locating the retinal breaks,

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resulting in the application of excessive retinopexy (1-4,7-11), and 2) the characteristics of retinal breaks in pseudophakic eyes.

The difficulty in viewing the peripheral retina in pseudophakic eyes is mainly due to modifications in the anterior segment, such as small pupil diameter, irregularity of pupillary edge/posterior synechiae, cortical remnants, posterior or anterior capsule opacifications, and optic aberrations at the rim of the implant. Other reasons for a higher failure rate are related to the characteristics of retinal lesions in pseudophakic RD: small or multiple post-oral breaks, vitreous incarceration into the operative wound leading to tractional detachment, the occasional absence of an obvious retinal lesion, and the presence of PVR.

It has become easier to locate retinal breaks and vitreoretinal traction with improved surgical techniques using vitrectomy, intraocular illumination, wide-angle viewing systems, and indentation with the help of liquid perfluorocarbons (12-16).

We conducted a prospective nonrandomized study in pseudophakic RD to examine whether the anatomic and functional outcome of the operated eyes improved after primary vitrectomy, which would be expected to reduce redetachment as well as PVR rates.

PATIENTS AND METHODS

Twenty-four consecutive eyes with pseudophakic RD were operated on with vitrectomy and encircling buckling (Group I) and 27 consecutive cases were operated with vitrectomy alone (Group II) in the Department of Ophthalmology at the University of Geneva. All patients had presented with an acute RD following cataract surgery and posterior chamber intraocular lens implantation.

Preoperative evaluation included measurement of visual acuity, intraocular pressure measurement, anterior and posterior slit-lamp biomicroscopy, and indirect and three-mirror contact lens biomicroscopy after pupillary dilatation with tropicamide 0.5% and phenylephrine 5%.

Scleral indentation was used in cases where the retinal periphery was partially hidden by pupillary posterior synechiae or capsular densities. All patients were examined daily until discharge and thereafter at one, two, three and six months and then yearly.

Vitrectomy-buckling (Group I)

The characteristics of the patients in this Group are summarized in Table I. The mean age of the 16 men and 8 women of the group was 64.8 years. Among the 16 right and 8 left eyes, 15 had had cataract surgery by phacoemulsification and 9 by extracapsular extraction. Rupture of the posterior lens capsule during surgery occurred in 8 eyes, 4 of which had anterior vitrectomy to remove vitreous from the pupillary area. In 5 eyes, pseudophakic RD occurred at least 18 months after Yag capsulotomy . Eleven eyes had no evident anterior segment pathology. The mean preoperative visual acuity was 0.95 logMAR, ranging from counting fingers to 0.8 (Tab. I)

The macular area was detached in 13 cases (Tab. II). Nine eyes had only one retinal break, and 15 had multiple breaks. In 7 of the 24 eyes, the causative RD lesion could not be identified at the preoperative examination (Tab. II).

TABLE I - PATIENTS MAIN DETAILS AND ANTERIOR SEGMENT PATHOLOGIES

	Vitrectomy-buckling (n = 24)	**Vitrectomy (n = 27)**
Mean (range) age, yrs	64.8 (44-93)	65.4 (52-80)
Phacoemulsification, no. (%)	15 (62.5)	23 (85.1)
Extracapsular, no. (%)	9 (37.5)	4 (14.8)
Peroperative capsular rupture, n. (%)	4 (16.7)	8 (29.6)
Anterior vitrectomy, no. (%)	4 (16.7)	8 (29.6)
Nd:Yag laser capsulotomy, no. (%)	5 (20.8)	1 (3.7)
No pathology of anterior segment, no. (%)	11 (45.8)	18 (66.7)
Preoperative VA range	CF to 0.8	CF to 0.8

VA = Visual acuity; CF = Counting fingers

Vitrectomy (Group II)

Table I also lists the main characteristics of Group II. The mean age of the 20 men and 7 women in this group was 65.4 years. Twenty-three eyes had previous cataract surgery by phacoemulsification and 4 by extracapsular extraction. Rupture of the lens capsule during surgery and anterior vitrectomy were recorded in 8 eyes. In one eye, pseudophakic RD had occurred 12 months after Yag capsulotomy . In 18 eyes there was no evident anterior segment pathology. The mean preoperative visual acuity was 0.7 logMAR, ranging from counting fingers to 0.8.

The macular area was detached in 9 cases (Tab. II). All eyes had at least one lesion causing the RD; 17 had multiple breaks (Tab. II).

In Group II, peripheral RD not affecting the macular area was more frequent. In Group I the causative retinal lesion was not detected preoperatively in seven eyes, and four cases in this group had stage C PVR (Tab. II).

Surgical technique

Under retrobulbar anesthesia, a standardized surgical approach, including vitrectomy by a three-port technique under the operating microscope and a wide-angle viewing system (Oculus 130, Oculus Wetzler, Germany) was used in both groups. In Group I; a 2-mm silicone encircling band was placed at the equatorial area (approximately 12 mm posterior to the limbus) to support the vitreous base.

Posterior capsular opacities were systematically removed to gain a better view of the retinal periphery. After removal of the posterior vitreous, 1 to 2 ml of perfluoro-n-octane over the optic disk was injected to stabilize the central retinal area and express the Schlieren phenomenon. The peripheral retina and vitreous base were systematically observed by scleral indentation (Fig. 1a), followed by endodrainage of the subretinal fluid through the existing retinal holes (Fig. 1b) and as complete as possible vitreous removal with dissection of any vitreous adhesions to the iris or the cataract wound, and shaving of the vitreous base. The retina was flattened with slow injection of perfluoro-n-octane. Endolaser or cryocoagulation was done (Figs. 1c and d) under direct visualization of the treated area over the retinal breaks, followed by fluid-air exchange and removal of the perfluoro-n-octane. The air-filled eye was flushed with 20 ml of the premixed gas, sulfur hexafluoride (SF_6 20% in air).

Local antibiotic and cycloplegic therapy was applied postoperatively for one month, with anti-inflammatory drugs for two months.

Statistics

Changes in visual acuity (VA) were analyzed by the Student t-test (VA values transformed into logMAR units).Statistical significance was considered at the 0.01 level. Counting fingers and hand motion were given values of 0.02 and 0.01, respectively.

RESULTS

The mean follow-up was 14 months (range 12-24) for Group I and 11.6 months (range 9-24) for Group II.

TABLE II - CASES WITH RETINAL DETACHMENT

		Vitrectomy-buckling (n = 24)	Vitrectomy (n = 27)
Macula detached, n (%)		13 (54)	9 (33)
PVR, no. eyes	Stage A	18	24
	Stage B	2	3
	Stage C	4	None
Unique break, no. (%)		9 (37.5)	10 (37)
Multiple breaks, no. (%)		15 (62.5)	17 (63)
Undetected breaks, no. (%)		7 (29)	None

PVR = Proliferative vitreoretinopathy

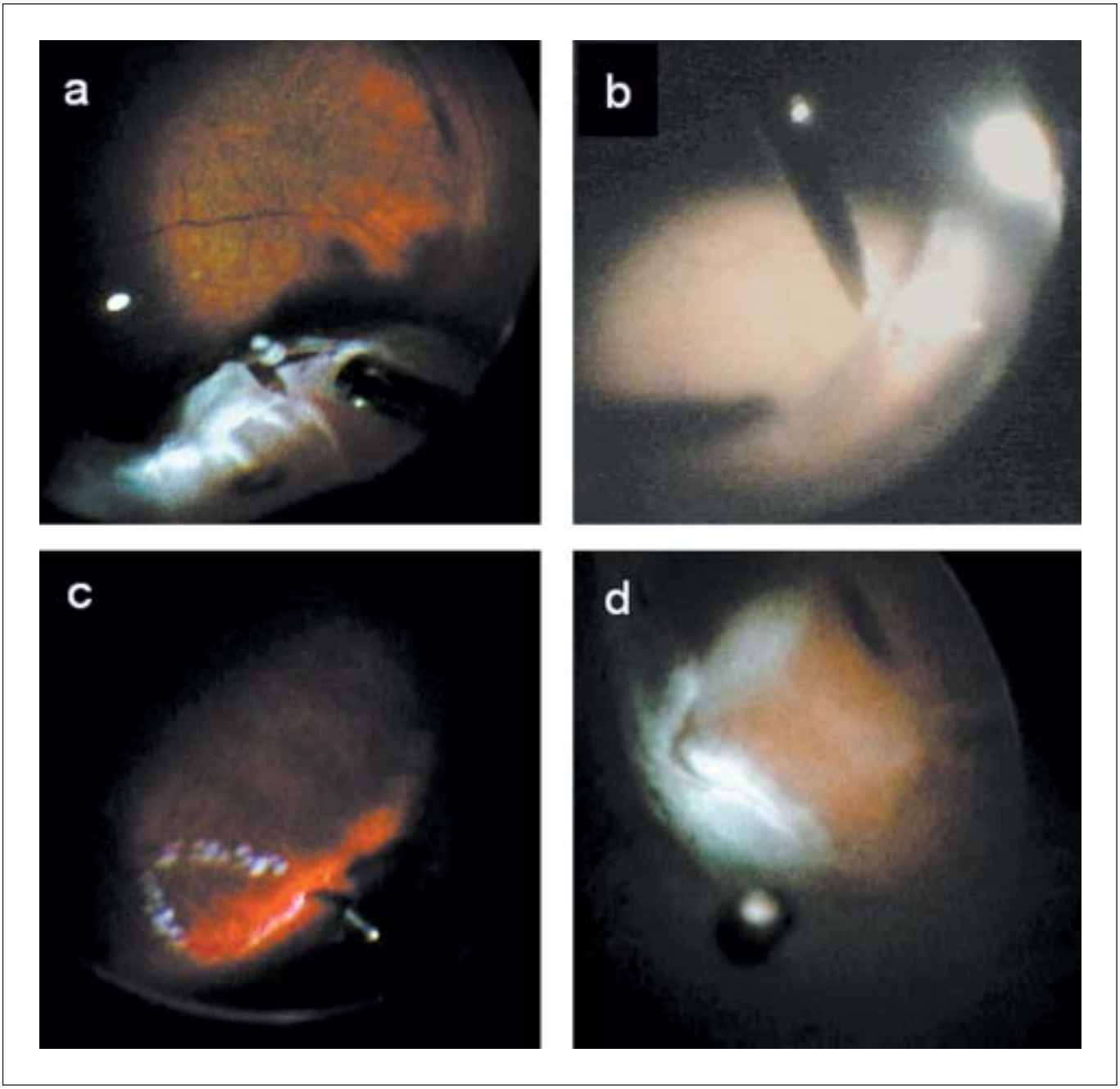

Fig. 1 - *Surgical sequences of vitrectomy for pseudophakic retinal detachment. Injection of a perfluoro-n-octane bubble in the vitreal cavity to stabilize the central retinal area, avoiding the risk of damage to the mobile detached retina; this way, the peripheral vitreous can be removed. Small lesions can be identified easily by external indentation (**a**). The retina was flattened by slow injection of perfluoro-n-octane. During the air-perfluoro-n-octane exchange, internal drainage of the remaining subretinal fluid at the periphery can be achieved through the breaks (**b**). Endolaser or cryocoagulation can be applied around the flattened breaks (**c**, **d**).*

Detection of retinal breaks during surgery

All 7 eyes in Group I with preoperatively undetected retinal breaks were found to have identifiable retinal breaks at surgery. In 10 eyes of Group I and 11 in Group II, additional retinal breaks not seen preoperatively were detected and treated during vitrectomy (Tab. III). In 9 eyes of Group I and 10 of Group II the

causative retinal break was a single round hole, usually at the vitreous base; in the other cases there were multiple breaks (combined round holes and horseshoe tears) (Tab. II). The lesions were more frequent in the upper temporal (48%) and upper nasal (28.5%) quadrants and less frequent in the lower nasal (12.5%) and lower temporal (11%) quadrants (Fig. 2).

Retinal reattachment

The retina was reattached in all eyes at the end of the follow-up . However, in two eyes in Group I, final retinal reattachment was only achieved after a second procedure, applied because the retina was detached owing to an unsuccessfully treated retinal hole in one eye and the development of inferior stage C PVR in the second eye.

Visual outcome

Figure 3 compares the postoperative and preoperative VA in macula on and macula off eyes in both groups . Mean VA at the end of the follow-up was significantly better in both groups than before surgery ($p < 0.01$). VA was 0.34 logMar for Group I and 0.21 logMar for Group II.

Almost all eyes achieved a VA more than 2/10 on the Snellen chart, and visual recovery was 6/10 or more in 11 eyes in Group I and 20 in Group II (Tab. III). After surgery, VA improved by an average of four or more lines in 62.5% of the vitrectomy-buckling group and in 55.5% of the vitrectomy group (Fig. 4). Final VA was better in Group II, but there was more improvement of VA in Group I, presumably because there were more macula off eyes in this group.

Changes in the mean refractive error

Postoperatively, the change in mean refractive error in the vitrectomy group ($p = 0.02$) did not significantly differ from the buckle-vitrectomy group, where the mean refractive error significantly increased ($p < 0.01$, Tab. III).

Complications

Pre-and postoperative complications for both groups are shown in Figure 5. Iatrogenic entry site breaks were observed in 3 (12.5%) eyes of Group I and in 6 (22%) of Group II. Retinopexy by cryocoagulation or endolaser was applied, and none of these lesions induced complications during the follow-up period.

The main postoperative complication was ocular hypertension, mainly due to the gas tamponade, presumably caused by the changes to the anterior chamber configuration when the iridocapsular plane is pushed forward (toward the corneal endothelium). Postoperative inflammation leading to a decrease in aqueous outflow is another possible explanation. Postoperative ocular hypertension occurred in 10 eyes (41.7%) in Group I and 11 (40.7%) in Group II. One eye in Group I and five eyes in Group II, with a history of glaucoma and need for hypotensive ocular medications, presented with raised intraocular pressure which was more difficult to treat than that of the other eyes. All cases had hypotensive treatment with beta-blockers and carbonic anhydrase inhibitor drops. Hypertony was resolved in all cases after the gas resorption, with no new glaucoma cases during the follow-up period.

One eye in Group I, which presented preoperative inferior PVR stage C had a recurrent RD due to this

TABLE III - POST-OPERATIVE FINDINGS

	Vitrectomy-buckling (n = 24)	**Vitrectomy (n = 27)**
Mean (range) follow-up, mos	14 (12-24)	11.6 (9-24)
Anatomic success, no. (%)	22 (91.7); 24 (100) after 2nd operation	27 (100)
Mean postoperative VA, logMar	0.34	0.21
VA ≥ 2/10, no. (%)	22 (91.7)	27 (100)
VA ≥ 6/10, no. (%)	11 (45.8)	20 (74)
Holes detected during surgery, no. (%) eyes	10 (41.7)	11 (40.7)
Mean refractive error	-3 diopters (-1.1 D preoperatively)	-1.61 diopters (-1.38 D preoperatively)

VA = Visual acuity

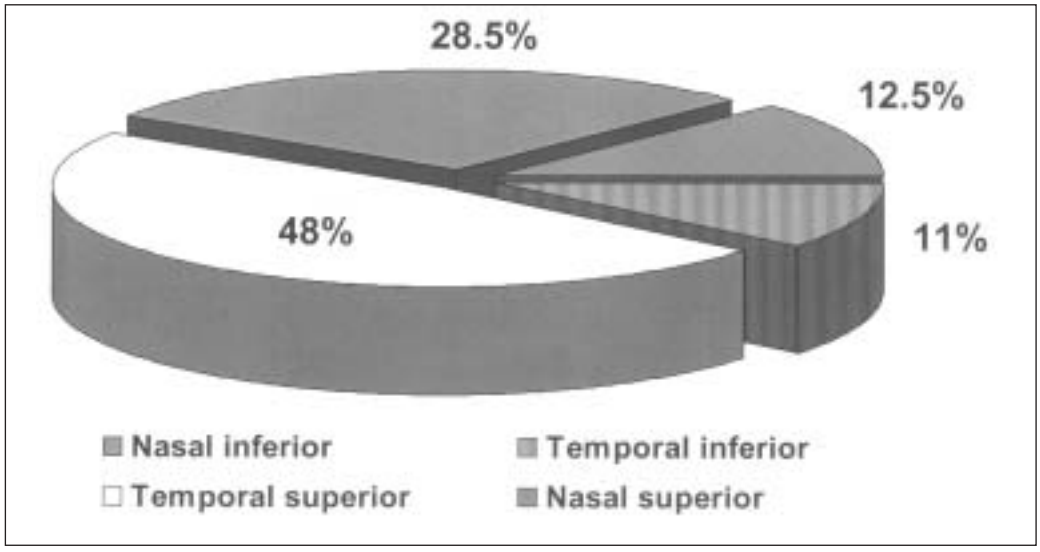

Fig. 2 - *Pseudophakic retinal detachment. Distribution of the retinal lesions in the various quadrants, including lesions detected during surgery.*

focal area of PVR. A second operation achieved retinal reattachment. Macular epiretinal membrane occurred in one eye of Group I. Because the visual symptoms were mild, this eye did not undergo any additional surgical procedure.

DISCUSSION

The results of this prospective study indicate that pars plana vitrectomy offers a number of advantages for the treatment of pseudophakic RD, as anatomic results and postoperative PVR rates are better than with extraocular surgery alone (3, 5-11). Difficulty in viewing the peripheral retina is usually due to modifications of the anterior segment of the eye, small pupillary diameter, irregularity of the pupillary edge, posterior synechiae, cortical remnants, anterior or posterior capsule opacifications, or optical aberrations at the rim of the implant, for both anterior and posterior chamber lenses. In both the groups in this series, treated eyes had posterior chamber lenses inserted in either the capsular bag or the sulcus. Opacification of the peripheral capsular bag following the collapse of anterior capsular remnants and iris capsule leading to displacement of the implant seems more frequent in sulcus-inserted eyes.

During vitrectomy, removal of capsular opacities and repositioning of the displaced lens allows better visualization of the retinal periphery and makes it feasible to search for any missed retinal breaks by deep scleral indentation. The use of a wide-angle viewing system offers the additional possibility of examination of the vitreous base and removal of any anterior vitreocapsular tractions (13-15). Better visualization of the ocular fundus after elimination of capsular and vitreous opacities allows easier detection of retinal breaks and precise cryo- or endolaser coagulation.

Exceptionally, in cases of undetected retinal lesions (12, 17, 18), a small retinotomy close to the retinal periphery followed by internal subretinal fluid drainage may be useful to flatten the retina. Because one or more retinal lesions were detected peroperatively in both groups, there was no need for this maneuver; however, iatrogenic retinotomies close to the posterior border of the detached retina do not seem deleterious to the anatomic results. Indeed, in a recent publication, retinotomies were applied at the posterior border of the detached retinal area (19).

The use of liquid perfluoro-n-octane (12, 17) is also helpful in managing the retinal periphery because the retina remains stable, allowing easier removal of the vitreous base and any vitreoretinal traction. Intraocular gas tamponade imposes a number of limitations during the postoperative period; namely, positioning the patient in order to ensure permanent contact of the retinal tears during the recovery period. Inferiorly located retinal tears were not considered a limitation to the vitrectomy procedure, as the vitreous cavity was filled by SF_6- 20% air.

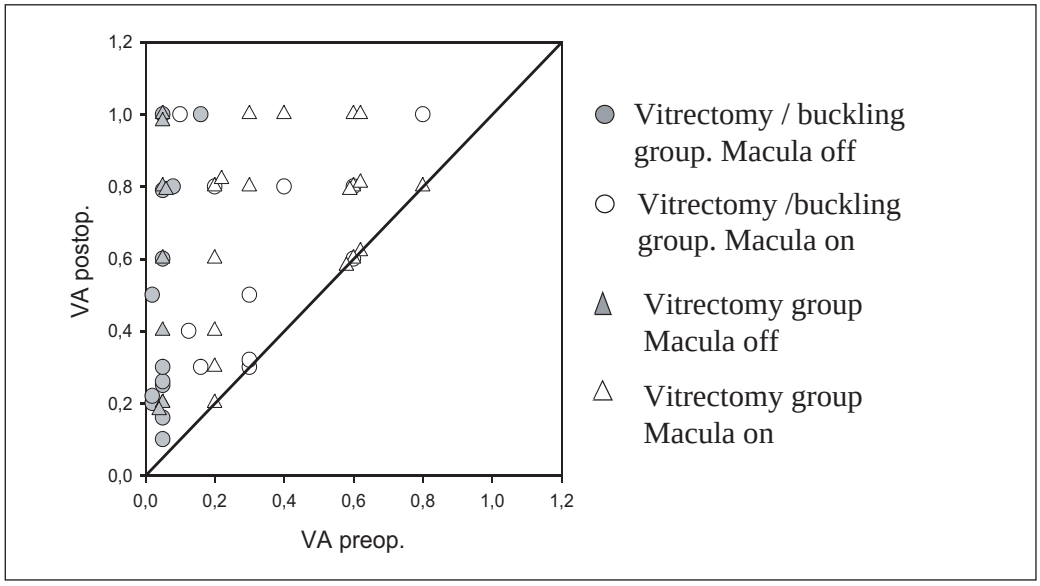

Fig. 3 - *Pseudophakic retinal detachment. Postoperative and preoperative visual acuity in macula on and macula off eyes in both groups.*

Vitrectomy and gas tamponade do present certain limitations, including difficulty in precise positioning to adequately flatten the retinal tears displacement with the high risk of gas expansion, and steep increases in intraocular pressure (20). Postoperative intraocular inflammation is rare.

Fluid-air exchange in pseudophakic eyes is occasionally restricted by air bubble formation at the posterior implant interface, in cases where the posterior capsule is damaged; this always occurs with silicone lenses. Although a viscoelastic substance applied at the posterior lens interface can improve visualization of the ocular fundus and facilitate the fluid-air exchange, visualization of the macular area remains more difficult. This raises the question whether silicone lenses are contraindicated in cases at high risk of RD because this material induces the adhesion of emulsified liquid silicone.

Postoperative hypertony owing to the intraocular gas tamponade was observed in more than one third of cases in both groups and was successfully managed without the need for long-term treatment. In most of our cases, topical beta-blockers and carbonic anhydrase inhibitors were sufficient. Follow-up treatment was still continuing in six cases who had a glaucoma history on medication before the RD. However, most of the eyes had normal intraocular pressure after resorption of the intraocular gas and regression of the intraocular inflammation. Postoperative hypertony as a result of vitrectomy for the management of pseudophakic RD has been described (2, 11, 12, 17, 18, 21). Numerous retrospective (4, 12, 14, 15, 19, 20, 22, 23) and some prospective studies (16-18, 24) have investigated the role of primary vitrectomy in the treatment of pseudophakic RD. The range of retinal reattachment (88-100%) with a single procedure (11, 12, 16, 17, 19) seems to be superior to that obtained in recent studies for scleral buckling procedures in both pseudophakic (49-84%) and aphakic (62-82%) eyes (5,11). However, the incidence of recurrence due to PVR seems similar for both procedures (8-14%) (8, 11, 12, 22, 25).

Another advantage of vitrectomy is that it causes no significant refractive change, compared to the encircling buckle procedure. In our series, there was a slight change in final refractive outcome in Group II (mean -1.61 diopters from -1.38 diopters preoperatively) compared to Group I (mean -3 diopters from -1.13 diopters preoperatively) (Tab. III). However, the debate continues about whether we should perform primary vitrectomy in order to avoid myopization. Pilot studies (16, 18) indicate that simple primary vitrectomy results are comparable to those obtained by vitrectomy and encircling buckle. However, comparison between studies is not always easy, because selection criteria vary from one study to another. Therefore, an ongoing randomized study (26), using identical diagnostic criteria and operation techniques, whose main aim is to establish whether vitrectomy gives better surgical results than extraocular surgery in pseudophakic eyes,

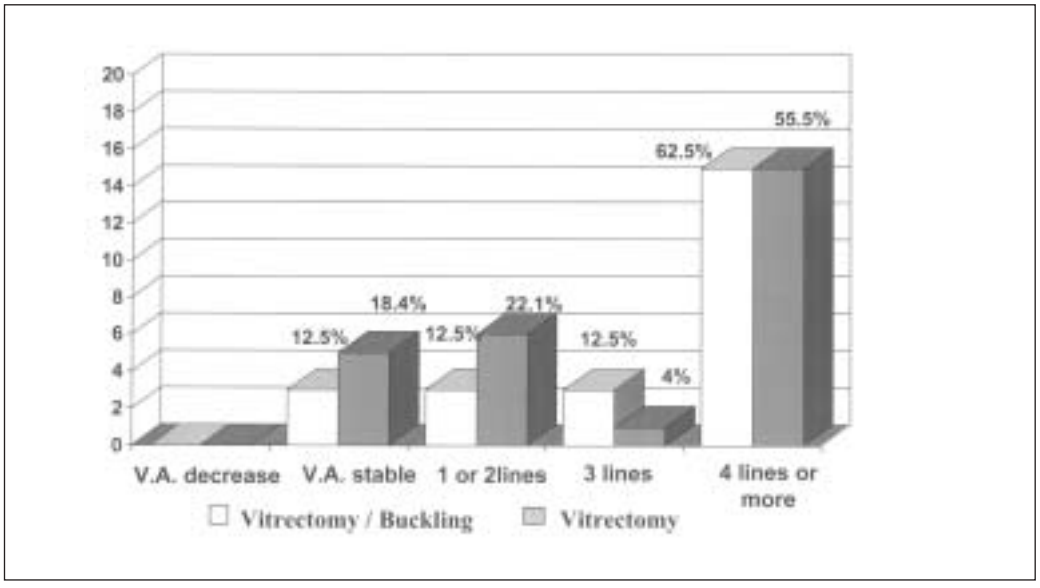

Fig. 4 - *Pseudophakic retinal detachment. Percentage of postoperative visual acuity increases of 1, 2, 3, or 4 lines or more.*

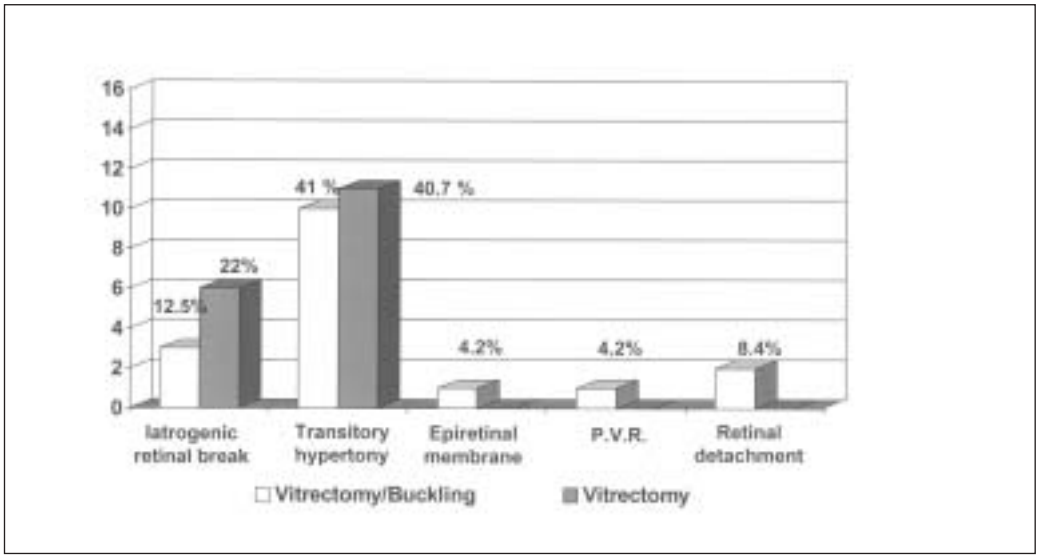

Fig. 5 - *Complications during follow-up after surgery for pseudophakic retinal detachment.*

should cast useful light on this point.

In conclusion, the present prospective nonrandomized study indicates that vitrectomy, with or without scleral buckling, achieves better anatomic and functional results than buckling alone, presumably through precise treatment of the causative RD lesions.

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